

WHAT IS CLAIMED IS:

1           1. A method for calibrating laser pulses from a laser eye surgery system  
2 using an image capture device, the method comprising:

3                 imaging a known object with an image capture device;  
4                 directing a pulsed laser beam onto a calibration surface so as to leave a mark  
5 on the calibration surface;

6                 imaging the mark on the calibration surface with the image capture device;  
7 and

8                 calibrating the laser eye surgery system by comparing the image of the mark  
9 on the calibration surface to the image of the known object.

1           2. The method of claim 1, wherein the imaged object comprises a circular  
2 shape having a known diameter.

1           3. The method of claim 2, wherein the known object comprises a circular  
2 chrome layer on a glass plate.

1           4. The method of claim 1, further comprising removing the known object  
2 prior to directing the pulsed laser beam onto the calibration surface.

1           5. The method of claim 1, wherein the imaging of the known object and  
2 of the mark on the calibration surface is carried out in the same position.

1           6. The method of claim 1, wherein the directing and imaging are carried  
2 out in the same plane.

1           7. The method of claim 1, wherein the directing and imaging are carried  
2 out in at least one of a laser focus plane or a treatment plane, and wherein imaging of the  
3 known object and imaging of the mark on the calibration surface are performed along an  
4 imaging optical path coaxial with a laser optical path.

1           8. The method of claim 1, wherein the calibration surface comprises  
2 photosensitive material, silkscreen material, Zapit paper, luminescent material, or  
3 photographic material.

1                   9.        The method of claim 8, wherein the mark on the calibration surface  
2   comprises a permanent change in color or a luminescent glow.

1                   10.      The method of claim 1, wherein the calibration surface comprises  
2   photoreactive material or polymethylmethacrylate material.

1                   11.      The method of claim 10, wherein the mark on the calibration surface  
2   comprises an ablation.

1                   12.      The method of claim 1, wherein the mark on the calibration surface has  
2   a diameter setting in a range from about 0.65 mm to about 6.7 mm.

1                   13.      The method of claim 1, further comprising increasing the pulsed laser  
2   beam diameter setting over time so as to form a plurality of marks, imaging the marks, and  
3   comparing the marks to the known object.

1                   14.      The method of claim 13, further comprising decreasing the pulsed laser  
2   beam diameter setting over time.

1                   15.      The method of claim 14, further comprising determining a hysteresis  
2   of a variable aperture.

1                   16.      The method of claim 1, further comprising determining a relationship  
2   between laser beam diameter and motor counts associated with an iris setting.

1                   17.      The method of claim 1, further comprising determining a shape of the  
2   laser beam.

1                   18.      The method of claim 1, further comprising determining a center  
2   position of the laser beam.

1                   19.      The method of claim 1, further comprising determining a drift of the  
2   laser eye surgery system by monitoring a variance in center positions for each scanned and  
3   imaged laser pulse.

1                   20.      The method of claim 1, further comprising determining a laser beam  
2   deflection.

1                   21.    The method of the claim 1, further comprising rotating an optical  
2 element along a laser delivery path and identifying a rotation-induced laser induced wobble  
3 from a plurality of marks.

1                   22.    The method of claim 1, further comprising ablating a patient's cornea  
2 with the calibrated system.

1                   23.    A method for calibrating laser pulses from a laser eye surgery system  
2 using a microscope camera, the method comprising:

3                   imaging a known object with a microscope camera;

4                   scanning a pulsed laser beam across a photosensitive material so as leave an  
5 ablation on the photosensitive material;

6                   imaging the ablation on the photosensitive material with the microscope  
7 camera;

8                   determining an iris calibration of a laser eye surgery system by comparing the  
9 image of the ablation on the photosensitive material to the image of the known object; and  
10 ablating a patient's cornea with the calibrated system.

1                   24.    A system for calibrating laser pulses from a laser beam delivery system  
2 comprising:

3                   an image capture device orientated toward a treatment plane;

4                   a known object positionable for imaging by the image capture device;

5                   a pulsed laser beam delivery system;

6                   a calibration surface supportable in an optical path of the pulsed laser beam so  
7 as to result in a mark on the calibration surface and for imaging of the mark on the calibration  
8 surface by the image capture device; and

9                   a processor coupled to the image capture device, the processor determining a  
10 calibration of the laser beam delivery system by comparing the image of the mark on the  
11 calibration surface to the image of the known object.

1                   25.    The system of claim 24, wherein the image capture device comprises a  
2 microscope camera.

1                   26.    The system of claim 24, wherein the known object comprises a circular  
2 chrome layer of known diameter on a glass plate.

1                   27.    The system of claim 24, wherein the known object and calibration  
2   surface are imaged in the same position.

1                   28.    The system of claim 24, wherein the known object and calibration  
2   surface are positioned in at least one of a laser focus plane or the treatment plane.

1                   29.    The system of claim 24, wherein the laser beam delivery system  
2   comprises a laser eye surgery system.

1                   30.    The system of claim 24, wherein the calibration surface comprises  
2   photosensitive material, silkscreen material, Zapit paper, luminescent material, photoreactive  
3   material, polymethylmethacrylate material, or photographic material.

1                   31.    The system of claim 30, wherein the mark on the calibration surface  
2   comprises an ablation, a permanent change in color, or a luminescent glow.

1                   32.    The system of claim 24, wherein the mark on the calibration surface  
2   has an iris setting in a range from about 0.65 mm to about 6.7 mm.